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When Is External Debt Sustainable?

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Abstract: We empirically examine the determinants of 'debt distress", which we define as periods in which countries resort to exceptional finance in any of three forms: (i) significant arrears on external debt, (ii) Paris Club resecheduling, and (iii) non-concessional IMF lending. Using probit regressions, we find that three factors explain a substantial fraction of the cross-country and time-series variation in the incidence of debt distress: the debt burden, the quality of policies and institutions, and shocks. We show that these results are robust to a variety of alternative specifications, and we show that our core specifications have substantial out-of-sample predictive power. We also explore the quantitative implications of these results for the lending strategies of official creditors.

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1. Introduction

This paper analyzes the probability of debt distress in developing countries and examines the implications of these results for the lending policies of official creditors and the borrowing strategies of low income debtor countries. We define debt distress episodes as periods in which countries resort to exceptional financing in any one of three ways: (i) incur substantial arrears on their external debt, (ii) receive debt relief from the Paris Club of creditors, and (iii) receive non-concessional balance of payments support from the International Monetary Fund. We find that three factors—the debt burden, the quality of institutions and policies, and shocks that affect real GDP growth—are highly significant predictors of debt distress.

Three features of this paper distinguish it from much of the large empirical literature on debt sustainability: first, we are interested in understanding the determinants of debt distress among very low-income countries that have been at the center of recent debt relief efforts such as the Highly-Indebted Poor Countries (HIPC) initiative. Much of the existing empirical literature focuses on middle-income emerging market economies. In many low-income countries, however, sovereign external borrowing is mostly, if not entirely, from official concessional sources. Unlike in middle and high income countries, few market indicators are available to signal risks of future sovereign debt default by low income countries. Barely any of the debt of these countries is traded in secondary markets, and rates of interest on new loans from official bilateral and multilateral creditors are highly subsidized and have little connection to risks of non-repayment. Developing an empirical model of the determinants of debt servicing difficulties in low-income countries can usefully inform the lending strategies of bilateral and multilateral concessional lenders.

Second, in this paper we find that non-financial variables are key determinants of debt distress, especially the quality of policies and institutions. The idea that policies and institutions matter for debt sustainability is not novel. But it has received relatively little attention in the empirical literature so far. A notable recent exception is the paper by

Reinhart, Rogoff, and Savastano (2003), who document the importance of countries' history of non-repayment and macroeconomic instability in driving market perceptions of the likelihood of default. Our evidence complements theirs by showing that not only does the history of non-repayment and weak policy matter for the likelihood of debt distress, but contemporaneous policies and institutions also matter. This opens the possibility that improvements in the policy and institutional environment in the medium term can lower the likelihood of debt distress for any given level of the debt burden. Moreover, we find that the contemporaneous effect of improvements in policies and institutions on the probability of debt distress is quantitatively large, and is roughly of the same order of magnitude as reductions in debt burdens.

Our third contribution is to consider explicitly the implications of our findings for the lending strategies of multilateral concessional creditors such as the World Bank and the IMF. In these institutions, notions of debt sustainability have focused almost exclusively on simple projections of debt burden indicators. For example, debt relief under the HIPC initiative is calibrated to ensure that countries emerge from the HIPC process with a present value of debt to exports of 150 percent. We find, however, that applying a common single debt burden indicator to assess debt sustainability in a large group of countries may not be very appropriate because institutions and policies, as well as shocks, also matter for the likelihood of debt distress. In this respect our findings are not dissimilar from those of Reinhart, Rogoff and Savastano (2003), who find that market perceptions of the probability of default in emerging markets are influenced by the history of non-repayment and macroeconomic instability as well as by the size of the debt burden. Our estimates also allow us to summarize striking tradeoffs between debt indicators, policies, and shocks for a given probability of debt distress: for example, countries at the 75th percentile of our measure of policies and institutions can have a present value of debt to exports that is three times higher than countries at the 25th percentile of this indicator, without increasing the probability of debt distress. These tradeoffs suggest that the targeted level of "sustainable" debt of a country should vary with the quality of its policies and institutions, as well as with the shocks that the country experiences.

A fundamental premise underlying our work is that avoiding debt distress, especially in low-income countries, is desirable. We think this premise is justifiable, for three reasons:

- First, resolving debt distress is costly. For example, costs associated so far with the debt reduction of the poorest countries of the world under the original and enhanced (Heavily Indebted Poor Countries) HIPC Initiative is estimated at $50 billion. Moreover, the costs of excessive debt extend beyond the costs of debt reduction alone. Excessive debt can also undercut support for policy reforms by political and civil society groups in debtor countries if they perceive that benefits from reforms will be directed to high debt service rather than deliver needed public services to the poor. The pressure to meet external debt service payments may also tempt debtor country governments to seek short-term solutions at the expense of fundamental, longer-term reforms. Creditors, as well, may be tempted to allocate resources according to resource needs rather than policy performance.[1]

- Second, non-repayment of loans to multilateral lenders can have perverse distributional effects among borrowing countries. Absent new resources from donors, the failure to repay concessional loans reduces the ability of development banks to provide new loans to other developing countries. Moreover, to the extent that new lending is intended for countries with sound policies and institutions, but countries with poor policies and institutions are more likely to fail to service their past debts, this can result in a transfer of resources from countries with good policies to countries with bad policies. The amounts at stake are non-trivial. Consider for example the World Bank-administered International Development Association (IDA), which provides very substantial resources to the world's poorest countries. As of 2003, IDA's portfolio consists of highly concessional loans with a face value of roughly $110 billion.[2] During the 2003

[1] Birdsall, Claessens, and Diwan (2002).
[2] The figures in this paragraph are taken from World Bank (2003).

fiscal year, it disbursed $7 billion in new loans, of which only $1.4 billion was financed by repayments on existing loans, with most of the balance coming from infusions from rich countries. However, given the long grace periods in IDA lending, this flow of repayments is anticipated to increase sharply in the future, averaging $2.3 billion per year over 2003-2008, $3.3 billion per year over the next five years, and $4.2 billion in the five years after that. Holding constant future donor infusions into IDA, it is clear that any disruption in this flow of future repayment resulting from episodes of debt distress will have significant implications for IDA's ability to provide new lending to the poorest countries.

- And third, in Monterrey, Doha, and Johannesburg, the global community endorsed a set of development objectives known as the Millennium Development Goals (MDGs). A key ingredient in this consensus is the accepted need for a significant increase—some estimates suggest a doubling—in official development assistance to poor countries. This highlights the additional challenge of ensuring that this additional financing is available on terms that are consistent with long term debt sustainability in low income countries. Financing the MDGs on inappropriate terms could lead to the re-emergence of debt problems in these countries and would undermine the very development goals that they are trying to achieve.

The remainder of this paper is structured as follows. In the next section, we provide a brief review of the existing empirical literature on determinants of debt default. We then describe in detail our methodology for identifying debt distress episodes in Section 3. Section 4 contains our main results, where we show that just three factors go a long ways toward explaining the risk of future debt distress: the public external debt burden of the country (traditionally measured as the present value of debt to exports or the debt service to exports ratio); the quality of policy performance of the government (as measured by the World Bank's Country Policy and Institutions Assessment (CPIA) index); and the experience of shocks (measured as real GDP growth). The results are robust to alternative model specifications and alternative measures of the key variables.

Moreover, an out-of-sample forecasting exercise suggests that up to 84 percent of debt distress events can be correctly predicted in advance.

Section 5 concludes with a discussion of the policy implications of our results. In brief, we argue that while the policy performance of low income countries should dictate the allocation of official development assistance, the terms of such resource flows, including the share of grants, should be calibrated with some reference to the risk of debt distress. Since the risk of debt distress depends not only on debt burdens, but also on policies and institutions, and shocks, the share of grants will need to vary significantly across countries. If adopted, such an approach will have important implications for the way in which loans and grants are delivered to low income countries by the entire international creditor and donor community. This is particularly important in light of the very substantial resource flows to the world's poorest countries that have been advocated in order to meet the Millenium Development Goals.

2. Relation to Existing Literature

The debt crisis of the early 1980s prompted a surge of empirical work to identify the factors contributing to debt servicing difficulties. Of these, the paper of McFadden et. al. (1985) is most closely related to ours. They construct an indicator of debt servicing difficulties based on arrears, rescheduling, and IMF support much like the one we use here, for 93 countries over the period 1971-1982. They find that the debt burden, the level of per capita income, real GDP growth, and liquidity measures such as non-gold reserves are significant predictors of debt distress, while real exchange rate changes are not. We find broadly similar results in our sample covering the following two decades, with some exceptions that are noted below. They also investigate the importance of state dependence and country effects and conclude that both matter, while in our updated sample we do not find comparable evidence of state dependence. Other papers in this early literature include Cline (1984), who focuses primarily on financial variables as determinants of debt servicing difficulties, and Berg and Sachs (1988) who in contrast emphasize "deep" structural factors such as income inequality (which they argue proxies

for political pressures for excessive borrowing) and a lack of trade openness as determinants of debt servicing difficulties among middle-income countries. In addition, Lloyd-Ellis et. al. (1990) model both the probability of debt reschedulings and their magnitude, again emphasizing financial variables. Interestingly, none of these papers focus on direct measures of the quality of policies and institutions.

Another strand of the literature on debt sustainability attempted to find a discontinuity in the relationship between debt burden indicators (usually the external debt-to-export ratio) and the incidence of default or market-based indicators of risk (such as the premium over benchmark interest rates on debt securities traded in the secondary market), for example, Underwood (1991) and Cohen (1996) These papers found that above a threshold range of about 200-250 percent of the present value of debt-to-export ratio, the likelihood of debt default climbed rapidly. This range then became the benchmark adopted by the original HIPC Initiative in 1996, and was subsequently lowered in 1999 under the Enhanced HIPC framework.

Several more recent papers are also related to our current work. Aylward and Thorne (1998) empirically investigate countries' repayment performance vis-a-vis the IMF, emphasizing the importance of countries' repayment histories and IMF-specific financial variables in predicting the likelihood of arrears to the IMF. Detragiache and Spilimbergo (2001) study the importance of liquidity factors such as short-term debt, debt service, and the level of international reserves in predicting debt crises, and find that all three are significant (although the effect of short-term debt primarily reflects endogeneity problems -- countries with imminent debt crises can only borrow short-term). While the sample of countries covered in these two papers includes many low-income countries as we do, neither paper focuses on the quality of institutions and policies.

We have already mentioned the paper by Reinhart, Rogoff, and Savastano (2003), which looks at historical determinants of "debt intolerance", a term used to describe the extreme duress which many emerging markets experience at debt levels that seem quite manageable by industrial country standards. Their key finding most relevant to our work

is that the Institutional Investor magazine's sovereign risk ratings can be explained by a very small number of variables measuring the country's repayment history, its external debt burden, and its history of macroeconomic stability. However, there are three key differences between our paper and this one. First, their dependent variable, the Institutional Investor rating, measures *perceptions* of the probability of debt distress, whereas we attempt to explain the incidence of *actual* episodes of debt distress.[3] Second, their sample consists mostly of middle- and upper-income countries. Third, as we will show in more detail below, we find that *contemporaneous* policy, and only to a lesser extent a *history* of bad policy and non-repayment, matters for the incidence of debt distress.

Finally, Manasse, Roubini and Schimmelpfennig (2003) is the recent paper most closely related to the analysis contained in this paper. They define a country being in a debt crisis if it is classified as being in default by Standard & Poor's or if it has access to non-concessional IMF financing in excess of 100 percent of quota. They then use logit and binary recursive tree analysis to identify macroeconomic variables reflecting solvency and liquidity factors that predict a debt crisis episode one year in advance. Once again, the key difference with the analysis contained in this paper is that Manasse et. al. restrict their analysis to a sample of emerging market developing countries for which such data is available (especially the Standard & Poor's data), whereas a special focus of this paper is the factors affecting debt distress in low income countries. Several of their key results, however, are broadly consistent with ours. They find that debt burden indicators and GDP growth, as well as a somewhat different set of measures of policies and institutions, significantly influence the likelihood of debt crises.

3. Empirical Framework

3.1 Identifying Debt Distress Episodes

[3] As documented in Reinhart et. al. (2003), country risk ratings such as these are only imperfect predictors of actual default episodes.

We define episodes of debt distress as periods in which any one or more of the three following conditions hold: (a) the sum of interest and principal arrears is large relative to the stock of debt outstanding, (b) a country receives debt relief in the form of rescheduling and/or debt reduction from the Paris Club of bilateral creditors, or (c) the country receives substantial balance of payments support from the IMF under its non-concessional Standby Arrangements or Extended Fund Facilities (SBA/EFF). The first condition is the most basic measure of debt distress: the inability to service external obligations resulting in an accumulation of arrears. But countries that are unable to service their external debt need not necessarily fall into arrears; they can also obtain balance of payments support from the IMF and, in addition, seek debt rescheduling or debt reduction from the Paris Club. The Paris Club assesses the "extraordinary external financing needs" of countries based on balance of payments projections set within a macroeconomic framework agreed as part of an IMF program, and takes into account all other sources of external financing available to the country. This paper does not define debt reductions under the HIPC Initiative as a separate indicator of debt distress, because all debt relief under the Initiative requires parallel debt reduction by the Paris Club on Naples terms (which involves a reduction in the debt of Paris Club members by 67 percent in present value terms).

Data on arrears and debt are taken from the World Bank's Global Development Finance (GDF) publication. The arrears data consist of arrears to all creditors (official and private), and refers only to arrears on long-term debt outstanding. We obtain data on commitments under SBA/EFF programs from the electronic version of the IMF's International Financial Statistics. Finally, we have compiled a comprehensive list of Paris Club relief episodes from data provided to us by the Paris Club. Our sample of countries consists of all low and midde-income countries reporting debt data in the GDF. As will be clearer below, we will select our explanatory variables for debt distress episodes to ensure that as many low-income countries as possible remain in our sample.

To implement our rule for identifying debt distress eposides, we need to identify thresholds for "large" values of arrears and "substantial" levels of IMF support. Our

initial threshold for arrears is 5 percent of total debt outstanding, and for IMF programs we look only at those for which committments are greater than 50 percent of the country's IMF quota. While any threshold for defining debt distress episodes would be somewhat arbitrary, it is worth noting that these values are quite high relative to the experience of the typical developing country. Pooling all country-years for all developing countries since 1970, the median value of arrears as a fraction of debt outstanding is 0.4 percent, and we are choosing a threshold that is roughly ten times greater. Similarly pooling all country-year observations, the median value of IMF committments relative to quota is zero, reflecting the fact that less than half the country-years in the sample indicate the existence of an IMF program including access to non-concessional IMF facilities. When such programs are in place, the median committment is 52 percent of quota. This means that our threshold identifies only the top half (in terms of committments relative to quota) of all SBA/EFF programs. Note that we do not include access to the Poverty Reduction and Growth Facility (PRGF) of the IMF as a debt distress indicator, since, in many cases, financing from this facility is no longer to meet temprorary payments imbalances but has become a source of long term development finance.[4] Finally, we include access to the Paris Club for debt rescheduling or debt reduction as an indicator of debt distress. The Paris Club itself designates its support as extraordinary financing once all other sources of financing are taken into account within the macroeconomic framework of an IMF-supported program. The rationale is that without such extraordinary financing, countries would not be in a position to service their debt without endangering implementation of the IMF program. In this way -- using the existence of significant arrears, Paris Club arrangements, or resort to non-concessional IMF facilities -- we can be certain that we are identifying severe cases of debt servicing difficulties. In any case, we have verified that our findings are generally robust to reasonable variations in these thresholds.

As a complement to debt distress episodes, we also define non-distress episodes, or "normal times", to use as a control group in the analysis that follows. We define these

[4] See a report by the IMF's Independent Evaluation Office on "The Prolonged Use of IMF Resources."

"normal times" as non-overlapping periods of five consecutive years in which *none* of our three indicators of debt distress are observed.

Figure 1 illustrates how we identify normal and debt distress episodes, for the case of Kenya (top panel), and Thailand (bottom panel). In each panel, we show SBA/EFF committments (solid black line), arrears (dashed line), and Paris Club relief (gray line). During the 1970s and 1980s, Kenya received balance of payments support in excess of 50 percent of its quota for a total of ten years, while during the 1990s it had four years in which arrears were more than 5 percent of debt outstanding. Finally, it also received substantial Paris Club relief in 1994, and again in 2000. Since Paris Club relief is typically based on three-year balance of payments projections by the IMF, we count the year of Paris club relief as well as the two subsequent years as the period indicating debt distress for each case. This means that in total, between 1970 and 2000, Kenya experienced 17 years of debt distress. In contrast, it managed only one five-year period of normal times, beginning in 1970, in which there were no arrears, debt relief, or IMF support. Thailand's experience, shown in the bottom panel of Figure 1, is quite different. It has neither had arrears nor has it approached the Paris Club. We only identify a total of six years of debt distress signalled by STBY/EFF programs, in the early 1980s and in the late 1990s during the East Asian financial crisis.

Finally, it is worth noting that in both Kenya and Thailand (and many other countries), there are cases where the debt distress episodes we identify are quite short, and in the case of Kenya, are immediately preceded by other distress episodes. In order to be sure that we are identifying severe episodes of prolonged debt distress, we begin by eliminating all seemingly temporary distress episodes that are less than three years long. In addition, since we want to measure all of our predictors of debt distress in the years prior to the outbreak of the distress episode, we eliminate all distress episodes that are preceded by periods of distress in any of the three previous years. This procedure identifies a total of 94 episodes of debt distress and 286 normal times episodes over the period 1970-2001. In our regression analysis which follows, we will work with a subset

of 57 distress episodes and 227 normal times episodes for which data on our core explanatory variables is available.

These 57 distress episodes are listed in Table 1, which also reports the average during the distress episode of arrears, Paris Club relief, and SBA/EFF support. This list contains many familiar episodes, including many Latin American countries during the debt crisis of the 1980s. Thailand and Indonesia during the more recent East Asian financial crisis. There are also many lengthy episodes of debt distress in Sub-Saharan Africa.[5] Figure 2 shows the incidence of debt distress over time, plotting the number of distress events beginning in each year since 1970. While many distress episodes began in the late 1970s and early 1980s, there has been a fairly steady incidence of new debt distress episodes since then, varying between one and three episodes per year.[6]

Table 2 provides some basic descriptive statistics for our sample of episodes. A striking feature of debt distress episodes is that they are long. In our sample, the median distress episode lasts fully 11 years. The longest distress episode is for the Central African Republic, which has been continuously in debt distress according to our definition since 1971, primarily because of high arrears. Comparing the top and bottom panel of Table 2 reveals very sharp differences in the indicators of debt distress in distress episodes relative to normal times. In distress episodes, average arrears are nearly 10 percent of debt outstanding, while average arrears in normal times episodes are less than one-half of one percent. During distress episodes, SBA/EFF support averages 83 percent of quota, while during normal times it is only 3 percent of quota. While by construction Paris Club relief is zero in normal times, it averages 1.7 percent of debt outstanding during distress episodes. Taken together, these figures suggest that our procedure identifies quite severe episodes of often prolonged debt distress. Finally, Table 2 shows that real GDP growth is substantially lower during debt distress episodes,

[5] One anomalous observation is Vietnam, which we identify as being in continuous debt distress since the late 1980s. This reflects continuous high levels of arrears relative to non-bilateral, non-Paris Club creditors, much of which is ruble-denominated. In the vast majority of our episodes of debt distress based on arrears primarily vis-a-vis multilateral and bilateral Paris Club creditors.

[6] Since our sample is restricted to distress events lasting at least three years, and our time period ends in 2001, we do not show any new distress events beginning in 1999-2001.

averaging 2.9 percent per year during periods of distress and 5.2 percent per year during normal times.

3.2 Modelling the Probability of Debt Distress

We will model the probability of debt distress using the following probit specification:[7]

$$(1) \qquad P[y_{ct} = 1] = \Phi(\beta' X_{ct})$$

where y_{ct} is an indicator value taking on the value of one for debt distress episodes, and zero for normal times episodes, each beginning in country c at time t; $\Phi(.)$ denotes the normal distribution function; X_{ct} denotes a vector of determinants of debt distress; and β is a vector of parameters to be estimated. Our sample consists of an unbalanced and irregularly spaced sample of observations of distress and normal times. In our core specification, we will consider a very parsimonious set of potential determinants of debt distress. In our regressions, we measure each of these variables in the first year of normal times episodes, and in the year prior to the beginning of each distress episode in order to reduce the potential endogeneity bias arising from the fact that our predictors of debt distress might worsen during the distress episode itself.

We consider three groups of explantory variables. The first consists of traditional debt burden indicators. In our core specifications, we will focus on two of these: the present value of debt service obligations relative to contemporaneous exports, and total debt service obligations as a fraction of exports. The debt service data is obtained from

[7] Since our interest is primarily in the incidence of distress episodes, rather than their precise timing, we rely on this very simple probit specification. Collins (2003) shows how the timing of currency crises can be modeled explicitly as the first-passage-time of a latent variable to a threshold, of which the simple probit specification here is a special case. Manasse, Roubini and Schimmelpfenning (2003) suggest that binary recursive tree analysis better captures the nonlinearities in the relationship between debt crises and their determinants, in a sample of middle-income countries. We have not yet investigated whether similar nonlinearities are important in our sample.

the World Bank's Global Development Finance publication, and is available since 1970. We rely on a new dataset on the present value of debt constructed by Dikhanov (2003). He applies currency-, maturity-, and time-specific market interest rates to the flow of debt service obligations on a loan-by-loan basis, using data from the World Bank's Debtor Reporting System database to arrive at a historical series of present value of debt for all developing countries since 1980. We also consider a number of other indicators, including the face value of debt relative to exports, debt service relative to current government revenues, and debt service relative to non-gold reserves.

Our second group of explanatory variables is intended to measure the quality of policies and institutions in the country. In our core specifications we will rely on the World Bank's Country Policy and Institutional Assessment (CPIA) ratings, which are available on an annual basis since 1977, although with some methodological changes over time. In some of our regressions, we extend this variable back to 1970 by imputing missing values with the fitted values of a simple OLS regression of the CPIA on the logarithm of one plus the inflation rate. Since the CPIA is not publicly available, we also confirm that our results hold if we use a publicly-available measure of institutional quality constructed by Kaufmann, Kraay and Mastruzzi (2002). This variable measures property rights enforcement or the rule of law, which we treat as time-invariant and so use only a cross-section of data for 2002.

Our third set of variables measures shocks that countries experience. Our most comprehensive measure of shocks is simply real GDP growth in constant local currency units, which reflects the confluence of all domestic and external shocks the country experiences. We also attempt, although with limited success, to identify the proximate causes of these shocks, by separately looking at real exchange rate movements and fluctuations in the terms of trade. In particular, we construct the growth rate of the real exchange rate relative to the US dollar using changes in the nominal exchange rate and GDP deflators. Positive values of this variable correspond to real depreciations. We measure the income effect of terms of trade changes as the current local currency share of exports in GDP times the growth rate of the local currency export deflator, minus the

share of imports in GDP times the growth rate of the import deflator. All data for these variables is taken from the World Bank's World Development Indicators database.

Table 3 reports the pairwise correlations among our determinants of debt distress. Not surprisingly, the present value of debt relative to exports, and debt service relative to exports, are quite strongly correlated at 0.45 in our sample. All of the remaining pairwise correlations are quite small, and with the exception of the correlation between policy and the present value of debt at –0.26, are less than 0.20 in absolute value. This gives us some indication that there is sufficient independent variation across our different determinants of debt distress that we can identify the partial effects of most of them.

Figure 3 illustrates the simple bivariate relationship between each of our explanatory variables and the distress indicator variable. In each panel, we divide the sample of observations by deciles of the explanatory variable of interest. We then compute the mean value of the explanatory variable by deciles, and plot it against the mean of the distress indicator variable by decile. Thus, for example, in the first panel of Figure 3, the mean value of the present value of debt to exports in the top decile of this variable is just above 4, and the proportion of distress observations in this decile is just above one-half.

The first part of Figure 3 shows that there is a strong positive correlation between a variety of debt burden indicators and the incidence of debt distress. An interesting feature of these graphs, however, is that the maximum value on the vertical axis rarely exceeds 0.5. This means that, even when traditional debt indicators are extremely high (in the upper deciles), there are many cases where debt distress does not occur. For example, in the case of the present value of debt relative to exports, only nine of 17 episodes in the top decile of this variable correspond to distress. Among the non-distress episodes in the top decile are Bangladesh, Burundi and Morocco, which all had a present value of debt of more than three times exports for most of the late 1980s and early 1990s yet did not experience debt distress. It is also interesting to note that there is little

visually-obvious evidence of non-linearities or threshold effects in the relationship between debt burdens and the probability of debt distress in our sample of events.

The second part of Figure 3 shows the relationship between debt distress and our measures of policies and shocks. There is a very strong negative relationship between measures of the quality of policies and institutions, and the incidence of distress. Fully 60 percent of the observations in the lowest decile according to the CPIA rankings correspond to distress episodes. To put this figure in context, recall that the unconditional probability of distress in our sample is just above 20 percent. This means that countries in the lowest decile according to policy experience debt distress at a rate three times the average for all countries. Turning to shocks, we see a strong negative relationship between GDP growth and distress. However, there is relatively little evidence of a significant simple correlation between two possible sources of shocks, real depreciations and terms of trade movements, and distress episodes.

4. Results

4.1 Core Specifications

Table 4 reports our core specifications. In the first seven columns, we restrict attention to a sample of 163 episodes during the 1980s and 1990s in which we have data on all four of our main variables of interest: present value of debt, debt service, CPIA ratings, and real GDP growth. In the first four columns, we show simple univariate probit regressions with each of these variables in turn. Not surprisingly, measures of debt burden, of the quality of policy, and of shocks are all highly significant determinants of debt distress. In terms of explanatory power, total debt service does best, with a pseudo-R-squared of 18 percent. However, the other variables, especially policy, all have quite respectable explanatory power as well.

In columns (5) and (6), we consider the partial effects of the debt, policy and shock variables, for the two debt indicators. We continue to find that all three variables

are highly significant and with the expected signs. Strikingly, even the magnitude of the estimated coefficients changes very little relative to the univariate specifications, consistent with the quite low correlations among our different determinants of debt distress. The explanatory power of these specifications is also substantially higher than in the univariate regressions, with pseudo-R-squareds of 23 percent (35 percent) for regressions with the present value of debt (debt service) measures. In column (7) we enter both the present value of debt, and total debt service relative to exports. We find that total debt service remains strongly significant, while the present value measure loses significance. One possible interpretation of this is that the debt service measure is a better proxy for liquidity problems, as opposed to the present value measure which captures solvency, and that distress episodes are more likely to be precipitated by liquidity problems.

In the last column, we show the same regression as in column (5), but in a larger sample extending back to the 1970s, where we have data on debt service but not the present value of debt. Again our results are very consistent, with debt burden, policy, and shocks all strongly predicting debt distress. The only difference with the previous sample covering the 1980s and 1990s is that the magnitude of the coefficient on growth is somewhat smaller, but still is highly significant.

It is also important to note that the magnitude of the estimated effects of debt, policy and shocks on debt distress is practically quite significant as well. For example, based on the regression in column (6), the probability of debt distress for a country at the 25^{th} percentile of debt service is 7 percent, but rises to 27 percent for a country at the 75^{th} percentile (holding constant policy and growth at their average values). Similarly, the probability of distress for a country at the 25^{th} percentile of policy is 26 percent, which is much higher than the probability of distress of 9 percent for a country with good policy at the 75^{th} percentile of this measure. Interestingly, the magnitude of this effect is almost identical to the magnitude of the debt service effect. This suggests that quantitatively, improvements in policy are as important as reductions in debt for reducing the probability of debt distress. In the case of growth, the magnitude of the effect is somewhat smaller,

but still non-trivial. The probability of distress for a country at the 25 percentile of growth is 20 percent, as opposed to 8 percent for a country at the 75th percentile.

Since our ultimate interest is in predicting debt distress episodes based on a parsimonious set of variables, it is useful to also examine the out-of-sample predictive power of each of these specifications. We first re-estimate each regression using data through 1989. We then use the use the estimated coefficients, together with the observed right-hand-side variables to predict the outcome of each of our observations in the 1990s. In particular, we predict that a debt distress episode will occur if the predicted probability conditional on the observed data included in each regression is greater than the unconditional probability of distress in the pre-1990 sample, which is 0.23 in the sample of 163 observations in first seven columns, and slightly lower at 0.20 in the last column. The first row reports the fraction of all episodes that are correctly predicted by each model, which ranges from 0.43 (for the model with growth only) to 0.84 (for the model with debt service, CPIA, and growth). One striking feature of the univariate regressions is that the out-of-sample predictive power of the CPIA is just as good as the predictive power of debt service, and considerably better than the predictive power of the present value measure. This suggests that the quality of policy is as good or better a predictor of debt distress as traditional debt burden indicators.

The remaining two rows disaggregate the correct predictions. The second row shows the fraction of the 10 distress episodes during the 1990s that are correctly predicted, while the third row reports the fraction of normal time episodes during the 1990s incorrectly predicted as distress events, i.e. false alarms. In most specifications, 70 percent or more of distress episodes are correctly predicted (with the exception of the regression with growth only, for which only 60 percent are correctly predicted. There is a lot of variation across specification in the likelihood of false alarms. In our best specification from a predictive point of few (column (6)), only 13 percent of normal times episodes are incorrectly signalled as distress. However, predictions based only on the present value of debt or growth have quite high probabilities of false alarms, at 55 percent and 63 percent of normal times episodes, respectively.

Overall, these results suggest that a considerable fraction of distress events can be correctly predicted using a very small set of just three explanatory variables: debt burdens, policy, and shocks. Moreover, the predictive power of the combined specification is considerably better than any univariate prediction, suggesting that it is important to take all three factors into account when assessing the likelihood of debt distress. Before we turn to the policy and operational implications of this finding in the last section of this paper, we first subject this basic specification to a number of robustness checks.

4.2 Robustness of Core Specification: Alternative Measures of Debt, Policy and Shocks

First we examine how robust our results are to alternative measures of debt burden, policies, and shocks. Table 5 reports results using three alternative debt burden indicators: the nominal value of debt relative to exports, debt service relative to current government revenues, and debt service relative to non-gold reserves. The first three columns correspond to the sample covering the 1980s and 1990s, and the second three columns correspond to the larger sample including the 1970s. In all cases we find that all three alternative debt indicators are significant, although again we see that the flow measures of debt service are much more significant than the stock measure of the face value of debt. Interestingly, however, comparing the first column of Table 5 with the fifth column of Table 4, we see that the present value measure of debt stocks is a better predictor of debt distress than simply the face value of debt. In all specifications in Table 5, we continue to find that policies and institutions as proxied by the CPIA are a highly significant determinant of debt distress, and in most cases growth also remains significant, although its significance is weaker than in our core specifications in the previous table.

In Table 6 we consider alternative measures of policies and shocks. In the first two columns we use the time-invariant measure of institutional quality from Kaufmann,

Kraay and Mastruzzi (2003). This measure of rule of law is significant at the 90 percent level in the smaller sample, and at the 99 percent level in the larger sample including the 1970s. The somewhat weaker explanatory power of this measure relative to the CPIA is probably due to the fact that it captures institutional quality in 2002, rather than at the beginning of each episode, and there is at least some variation over time in institutional quality. Importantly, however, we continue to find that the debt burden and shock measures from our core specification remain highly significant, and with only modest changes in their magnitudes. In the remaining four columns of Table 6 we look at two potential sources of shocks to GDP growth: real depreciations, and changes in the terms of trade. We find very little evidence of the significance of either of these direct measures of shocks in predicting debt distress, with only terms of trade growth being marginally significant in one specification. We do however continue to find that debt burden and policy are highly significant.

4.3 Robustness of Core Specification: Level of Development

We now investigate the role of cross-country differences in the level of development in driving our results. In the first two columns of Table 7 we add log real per capita GDP at PPP to our basic specifications with the present value of debt, and with debt service. We do this to check whether debt burdens and policies, both of which are strongly correlated with per capita income, are not simply serving as proxies for the level of development. We find that per capita income is statistically insignificant, and moreover, the magnitude and significance of our core variables of interest change little with the addition of this variable.

The remaining colums of Table 7 investigate how the determinants of debt distress differ in the richer and poorer halves of our developing-country sample. We return to the core specifications in columns (5) and (8) of Table 4, and divide our sample in half at the median level of per capita income. We then re-estimate our core specifications in these two subgroups. Since our main interest here is how the magnitude of the estimated effects of debt, policies and shocks differ in the two samples, we report

the estimated marginal effects instead of the slope coefficients in columns (3)-(6) of Table 7, together with the absolute value of the t-statistics associated with the underlying coefficients.

Our results show interesting similarities and differences in the two subsamples. In the both the low-income and high-income sample, we continue to find that debt burdens and policy matter for debt distress, although the statistical significance is somewhat weaker in some specifications. Interestingly, however, the magnitudes of the estimated effects of debt burdens and policy are quite different. In the low-income sample, the marginal effect of improvements in policy on the likelihood of debt distress is twice as large as in the high-income sample. Conversely, the marginal effect of higher debt burdens is almost three times as large in the high-income sample as in the low-income sample. Although we find little evidence that these differential effects are statistically significant, qualitatively at least this suggests a relatively greater role for policies and institutions as captured by the CPIA in the poorest developing countries, while a greater role for more traditional financial indicators of debt burden in richer developing countries.

Finally, our evidence on the importance of shocks as proxied by real GDP growth remains, but is somewhat weaker in the two subsamples than in the full sample. However this, together with our failure to find strong evidence of statistically significant differential effects in richer and poorer developing countries, may simply reflect our much smaller sample size in the two subgroups. Overall, however, these results suggest to us that our main findings are not driven exclusively by richer or poorer developing countries, nor simply by differences between these two groups of countries. Rather, our results suggest that debt burdens, policies and shocks matter for debt distress both in low-income and middle-income developing countries.

4.4 Robustness of Core Specification: Role of History

We finally ask whether the significance of policy in predicting debt distress reflects the effect of current policies and institutions on debt distress, or whether it simply proxies for a history of bad policies and institutions that permanently raises the probability of debt distress for a country. This question is motivated by the finding of Reinhart, Rogoff, and Savastano (2003) that a country's history of default and bad policy is a robust predictor of investors' perceptions of the likelihood of sovereign default. We check for this in several ways.

First, we add to our core specifications a variable capturing a country's history of bad policy in the pre-sample period. In particular, for the regression with the present value of debt relative to exports during the 1980s and 1990s, we add a variable measuring the fraction of years between 1960 and 1979 that the country's inflation rate was greater than 40 percent. For the regression with debt service covering the 1970s as well, we construct the same inflation history variable, but only for the 1960s. We then include this variable in the regression to control for a country's history of bad policy. In column (1) we find that the country's inflation history during the 1960s and 1970s is a significant predictor of debt distress during the 1980s and 1990s. However, the coefficient on contemporaneous policy remains highly significant and the magnitude of the effect is only slightly smaller in absolute value relative to the core specification. In the larger sample of observations in column (2), we do not find any evidence of a significant effect of inflation history, while contemporaneous policy remains significant. Together, these results suggest that while the history of policy does matter to some extent, it does not appear to dominate the effect of contemporaneous policy on the probability of debt distress.

Second, we attempt to disentangle the effects of cross-country differences in long-run average policy performance from within-country fluctuations over time in policy performance. Because of the intrinsic nonlinearity of the probit specification, we cannot isolate the between- and within-country variation in the data with a simple differencing or averaging transformation. Instead, we separate our measure of policy into a country-average of policy, and a deviation of contemporaneous policy from that average, and we

enter both terms into the regressions separately. If the significance of policy in our basic specification reflects only the fact that distress is more likely to occur in countries with persistently poor policies, then we should find that average policy is significant but the deviation from average is not. In columns (3) and (4) we find that both average policy and the deviation of policy from its time average are significant predictors of debt distress. This casts doubt on the hypothesis that our policy variable matters only because it is picking up long-run differences across countries in the quality of policy. Moreover, in column (3) we find that we cannot reject the null hypothesis that the coefficient on average policy and on the policy deviation are equal, justifying the inclusion of simply the level of policy as we do in our core specification. In column (4) in our larger sample including the 1970s, we do find a statistically significant difference between the effects of average policy and its deviation, but we still do find a significant effect of both.

For completeness, in the next two columns of Table 8 we perform the same decomposition exercise, but now for real GDP growth. The rationale for this robustness check is the same as before. It is possible that our growth variable is simply picking up the difference between fast-growing and slow-growing countries, and the probability of distress is higher in the latter. In this case, however, we find no evidence that our growth variable is picking up these persistent cross-country differences. We find that the deviation of real GDP growth from average is highly significant, while averages over time of real GDP growth are not significant determinants of debt distress.

Third, we directly investigate the role of a country's history of default on its external obligations as a predictor of debt distress. In particular, we use the database of default episodes compiled by Reinhart, Rogoff and Savastano (2003) to identify the fraction of years between independence (or 1824, whichever is later) and 1980 in which a country was in default on its external borrowing.[8] We then add this variable to our core specification covering distress episodes in the 1980s and 1990s. The results of these regressions are reported in columns (7) and (8) of Table 8. In column (7) we report a

[8] Since the Reinhart et. al. dataset is a comprehensive list of external debt default episodes, we set this variable to zero for those countries not appearing in their dataset.

univariate regression on just the default history variable, and confirm the spirit of Reinhart et. al. finding that this variable is a good predictor of debt distress. The default history variable enters significantly at the 5 percent level, although its explanatory power is quite modest relative to the other univariate specifications in Table 4. More interesting for our purposes is the final column of Table 8, where we now add the default history variable to our core specification. The significance of the default history variable drops to the 10 percent level. Importantly however, the significance and magnitude of our core determinants of debt distress, debt burdens, policy and shocks, are virtually unaffected the the inclusion of this variable. In addition, the incremental explanatory power of the default history variable is quite modest, with the pseudo-R-squared increasing from 0.23 in the core specification in Table 4, to 0.26 here. We conclude from this that, while default histories clearly matter to some extent for the incidence of debt distress, it is also clear that history is not destiny – contemporaneous values of debt burdens, institutions and policy, and shocks matter much more for predicting the incidence of debt distress.

All of the robustness checks discussed so far in this subsection have to do with the importance of time-invariant country-specific determinants of debt distress that may be correlated with our core set of explanatory variables. As a fourth and final robustness check for the importance of such factors, we estimate the following dynamic probit specification with unobserved country-specific effects:

$$(2) \qquad P[y_{ct} = 1] = \Phi\left(\beta' X_{ct} + \rho \cdot y_{c,t-} + \mu_i\right)$$

where $y_{c,t-}$ denotes the value of the distress indicator in the episode immediately prior to the one occurring at time t in country c; ρ is a parameter capturing the persistence of distress, and μ_i is an unobserved country-specific time-invariant effect capturing persistent country characteristics that influence the probability of debt distress. As noted above, this country-specific effect cannot be eliminated by a differencing transformation common in linear panel data models. Moreover, since we have a lagged dependent variable, we are faced with the familiar initial conditions problem: loosely, we cannot

ignore the fact that by construction, the lagged dependent variable is correlated with the unobserved individual effect.

We estimate this model by applying the initial conditions correction suggested by Wooldridge (2002). He proposes modelling the individual effect as a linear function of the initial observation on the dependent variable for each country, as well as time averages of all of the right-hand-side variables. He also shows that this specification can be simply estimated using standard random-effects probit software, as long as the list of explanatory variables is augmented with the initial value of the dependent variable and time averages of all of the right-hand-side variables for each country.

The results of this specification can be found in Table 9.[9] The first four rows of this table contain the main coefficients of interest, on the lagged dependent variable and our three usual explanatory variables of interest. As before, we continue to find that debt indicators, policy, and growth remain significant predictors of the probability of debt distress. Although the point estimates of the coefficients differ somewhat relative to previous specifications and in some cases the significance is somewhat weaker, the results for these variables remain quite consistent with those discussed earlier. Interestingly, we find no evidence that debt distress in the previous period significantly raises the probability of distress in the next period, after debt burdens, policy and growth have been controlled for. Taken together, these results suggest that unobserved time-invariant country characteristics are not responsible for our main results, and that the observed persistence of debt distress over time is mostly due to the persistence of debt burdens, policies, and shocks rather than a recent history of distress itself.[10]

[9] Since we have an irregularly spaced panel, there is a risk of misspecification in treating the coefficient on the lagged dependent variable as equal across all observations regardless of the spacing between them. In principle we could allow this coefficient to vary across observations with some non-linear parametric function of the lag length, at the cost of considerably complicating the estimation. Instead, we adopt the shortcut of dropping those observations for which the lag until the previous observation is greater than 10 years.

[10] This last result contrasts with the finding of McFadden et. al. (1985), who do find evidence for state-dependence.

5. Policy Implications and Conclusions

We have showed that the likelihood of debt distress can be substantially explained using three factors: debt burdens, policy, and shocks. We conclude by considering the implications of these findings for the lending policies of official creditors.

The first of these implications is quite straightforward: *there is substantial value-added in assessing the quality of policies and the severity of shocks in addition to debt burden indicators when assessing the probability of debt distress of individual countries*. The regression results clearly show that policy performance and the severity of shocks matter a lot in predicting which countries are likely to suffer debt distress. From a predictive standpoint, there are non-trivial differences between the predicted probability of distress based on debt burdens alone, and the probability of distress based on the fully specified multivariate regression equation. We illustrate this in Figure 4, where we graph the present value of debt relative to exports in 2001 for all countries, against the predicted probability of debt distress using the most recently available data for 1999-2001 and the regression in the fifth column of Table 4. We indicate the HIPC threshold of 150 percent debt/exports as a vertical line, and the historical unconditional probability of debt distress in our sample of 0.23 as a horizontal line. As Figure 4 illustrates, there are many countries which may have low debt burdens relative to these benchmarks, but still have high probabilities of debt distress owing to either to poor policy performance or recent poor growth performance. Similarly, there are some countries that are able to bear significantly higher debt burdens without a higher-than-average distress probability because of the quality of their policies and the robustness of their economic growth.

Our second policy implication follows closely from the first: *using a single debt threshold for all low income countries to identify countries that are vulnerable to debt distress ignores the importance policies and shocks. Country-specific debt thresholds reflecting policies and shocks are more appropriate.* In Figure 5, we illustrate how these other factors influence the "sustainable" debt level of a country. In the top panel, we consider a hypothetical country with a growth rate of 3.6 percent equal to the mean of our

sample. Then, for the indicated value of policy on the horizontal axis, we compute the level of the present value of debt relative to exports that would be consistent with a predicted probability of debt distress equal to 10 percent, 25 percent, and 40 percent, and we graph these (truncating negative values at zero).[11] Consider first the line corresponding to a distress probability of 25 percent, which is equal to the historical unconditional average rate of debt distress in our sample. It tells us that a country with average growth, and poor policy (corresponding to a CPIA score of 3 which is roughly the first quartile of our sample), would be able to tolerate a present value of debt to exports of less than 100 percent. In contrast, a country with good policy (corresponding to a CPIA score of 4.2 which is the fourth quartile of our sample), would be able to tolerate a debt level nearly three times higher with the same distress probability. Of course, for lower (higher) debt distress probabilities, these lines shift down (up), corresponding to lower (higher) levels of debt for any level of policy.

The bottom panel of this Figure 5 does the same exercise, but instead holding policy constant at its mean value, and varying growth from the bottom to the top quartile. Again, we see sharp differences in the level of debt that are consistent with a given distress probability. For countries with low growth and average policy, a debt level of 200 percent of exports is consistent with a debt distress probability of 25 percent, while countries with high growth can tolerate a 300 percent debt/export ratio with the same distress probability. Of course, the precise magnitudes of the effects of differences in debt and policy on these implied debt levels depends on all of the estimated coefficients in the regressions on which these estimates are based, and these are subject to margins of error and vary across specifications. Thus, these figures can only give us a sense of the rough order of magnitude of effects of policies and shocks on the level of debt consistent with a given distress probability.

Our third and final policy implication is also straightforward: *the risk of debt distress should be taken into account when deciding the terms and modalities of resource*

[11] These implied debt levels are obtained by solving $p=\Phi(\beta_0+\beta_1 x Debt+\beta_2 x Policy+\beta_3 x Growth)$ for debt, where p is the desired probability of debt distress.

transfers to low income countries. The objective here is to ensure that resources are provided in such a way as to keep debt distress probabilities at manageable levels, while at the same time ensuring that aid is targetted to countries with good policies and institutions. Clearly, this will involve altering the concessionality of aid by using a mixture of grants and loans, with the mix tailored to the risk of debt distress in each country. This point is especially important in light of the much larger flows of development finance that have been advocated if countries are to meet the Millenium Development Goals. It has been estimated that an additional $50 billion per year in development finance will be required to reach these targets, which would represent approximately a doubling of current flows to developing countries.

If the additional ODA flows envisioned in light of the MDGs are provided primarily as (even concessional) loans, the vast majority of recipient countries will experience very sharp increases in their predicted debt distress probabilities, and are likely to experience serious difficulties repaying these loans in the future. The empirical results in this paper provide rough-and-ready estimates of the scale of this problem, which we illustrate with the following counterfactual exercise. We first take the most recently-available data on low-income countries' debt burdens, policies, and growth rates, and use it to compute current estimated probabilities of debt distress, as in Figure 4. We then assume that an additional $100 billion in new lending is allocated across low-income countries in proportion to these countries' IDA borrowing during the second half of the 1990s.[12] We then compute the new present value of debt relative to exports, assuming that this new lending has the same average concessionality as each country's stock of past borrowing. Finally, we calculate the new probability of debt distress, assuming that policies and growth are unchanged.

Figure 6 summarizes the results of this calculation. The horizontal axis reports the current predicted distress probabilities, while the vertical axis reports the predicted

[12] Since IDA lending is already allocated across countries according to a formula that explicitly recognizes good policy and high poverty, this seems like a reasonable basis to allocate new lending in our hypothetical experiment.

distress probabilities reflecting the additional $100 billion in lending. Several observations on this calculation are in order.

- This additional lending would represent a very substantial increase in the debt burden of many low-income countries. Although the $100 billion in additional lending represents only about 15 percent of the total stock of external debt of these countries, this understates the increase in debt burden of a "typical" low income country because China accounts for nearly one-quarter of the external debt of this group of countries but borrows relatively little from IDA because of its access to commercial finance. In contrast, the average increase across countries in the face value of debt is nearly 40 percent of exports, and the average increase in the present value of debt, given past patterns of concessionality, is 25 percent of exports.
- The counterpart of the increase in debt burdens is a substantial increase in the probability of debt distress for many low-income countries. This can be seen from Figure 5, where for each country the vertical distance to the 45-degree line indicates the increase in distress probability associated with this increased concessional lending. Consider Uganda, with its good policy and fairly low income levels: it receives a substantial fraction of new lending, increasing its present value of debt from 1.7 times exports to nearly 3 times exports. Given current policy and growth, this would increase the predicted probability of debt distress from 13 percent to 21 percent. More dramatically, consider Ethiopia, which in our scenario would see the present value of debt increase from 3 times exports to 5 times, and the debt distress probability increase from 30 percent to 50 percent. Note also that countries with very high current debt distress probabilities will see little increase in this probability, but this is simply because their initial levels are already so high. The increases in distress probabilities for countries with low initial probabilities is also small. This largely reflects the fact that many of these countries have higher per capita incomes and have borrowed relatively little from IDA in the past, and so receive little additional lending in our hypothetical scenario.

- It could be argued that these calculations overstate the effects of additional lending on debt distress in low income countries because they ignore likely future export growth which would contribute to lower debt burdens relative to exports. However, many of the countries receiving new lending in our hypothetical scenario have had sharply *negative* export growth over the past five years, so if past trends continue we would be understating the increase in debt burdens in these countries. In fact, for the group of IDA borrowers as a whole, the unweighted average growth rate of nominal dollar exports between 1997 and 2001 was only 2.8 percent per year. Moreover, our hypothetical scenario results on average in a greater proportionate increase in the present value of debt in countries where past export growth was low or negative. Thus, if we were to adjust downward the increase in the debt to export ratio by historical cumulative export growth over the past five years, we find that the unweighted average percentage increase in this debt burden indicator is even higher than when we ignore future export growth (65 percent versus 40 percent).

This calculation highlights the importance of rethinking the average terms of resource flows to low-income countries if sharp increases in debt servicing difficulties are to be avoided. These calculations show that, if financing the MDGs using external aid is to be taken seriously, then a greater role for grants will be required, and, for countries with a given quality of policies, that the share of grants will need to be significantly higher where debt distress probabilities are high, and lower where distress probabilities are low. At the same time, however, grants should not supplant loans one-for-one as the probability of debt distress increases, for two reasons. First, replacing loans with grants equal to the face value would represent a vastly larger resource transfer than is currently envisioned by donors, and obtaining the necessary financing would be difficult. Second, such a scheme would implicitly "reward" countries implementing weak policies with more grants, and greater overall resource transfers, undermining efforts to target aid to countries with good policies.

One possible scheme for calibrating the share of grants without exacerbating moral hazard problems would be the following three-step process. First, the total amount of new lending can be converted into its grant-equivalent from the donors' perspective, by taking the face value of the new lending and subtracting the present value of future debt service. Second, this grant-equivalent could be allocated across countries following some kind of aid allocation rule that recognizes the importance of "needs" (i.e. the prevalence of poverty), and "aid effectiveness" (i.e. a function of the quality of policies and institutions of the recipient country). Third, for countries below a specified distress probability (in other words, where the capacity for servicing debt in the future is considered relatively good), this grant equivalent could be "grossed-up" into a much larger amount of concessional lending with the same grant equivalent. Such a scheme would have a number of advantages:

- Most obviously, by calibrating the amount of new lending to the probability of distress, it avoids the large and likely unsustainable increases in debt burdens that would follow from large-scale across-the-board new lending to low-income countries.
- This scheme also ensures that resources are targetted to countries with high poverty and good policies, and moreover provides and additional reward for good policy. This is because countries would prefer to be able to "gross-up" as much of their grant-equivalent allocation as possible into lending, and improvements in policy can create additional "headroom" for new borrowing by lowering the probability of debt distress.
- This scheme also would not require any new commitments by donors to finance new grants, over and above the implicit commitment to new transfers in grant equivalent terms implicit in donors commitments to lending at existing rates of concessionality. This is because donors would be committing to the same transfer to a country whether they provide only the grant element, or they convert this grant element into loan with the same grant equivalent. If anything, the resource transfer from the perspective of the donor might be even smaller, to the extent that calibrating the fraction of loans to the

probability of debt distress results in higher actual repayment rates in the future.

In summary, we have shown in this paper that the risk of debt distress depends significantly on a small set of factors: debt burdens, policies and institutions, and shocks. We have shown that this finding is robust to several robustness checks, and that our empirical model does a reasonable job of predicting future debt distress. While at some level these results should not be too surprising, they do have profound implications for how resource transfers to low-income countries could be financed. Our results indicate that the probability of debt distress is already high in many low-income countries, and is likely to increase sharply if the large-scale development finance required to meet the Millenium Development Goals is provided in the form of concessional lending at historic levels of concessionality. We have also proposed a simple scheme of financing resource transfers to low-income countries in a way that controls the probability of debt distress, provides good incentives to borrowers, and does not involve additional donor commitments to finance large-scale new grants.

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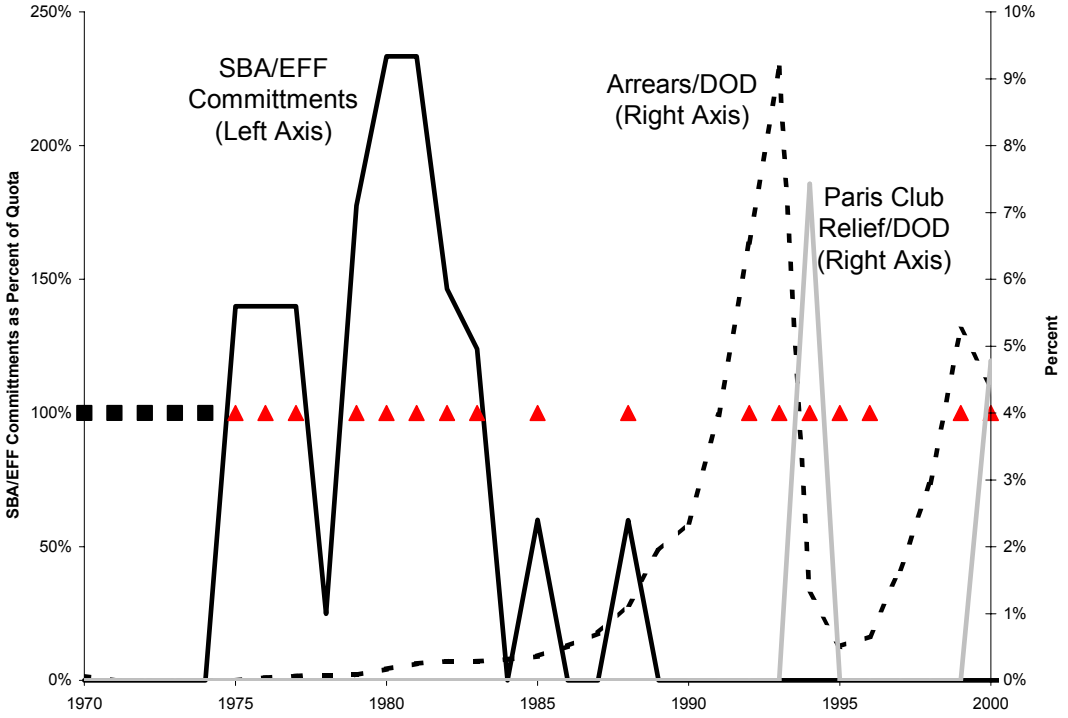
Figure 1: Identifying Debt Distress Events

Kenya



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Thailand

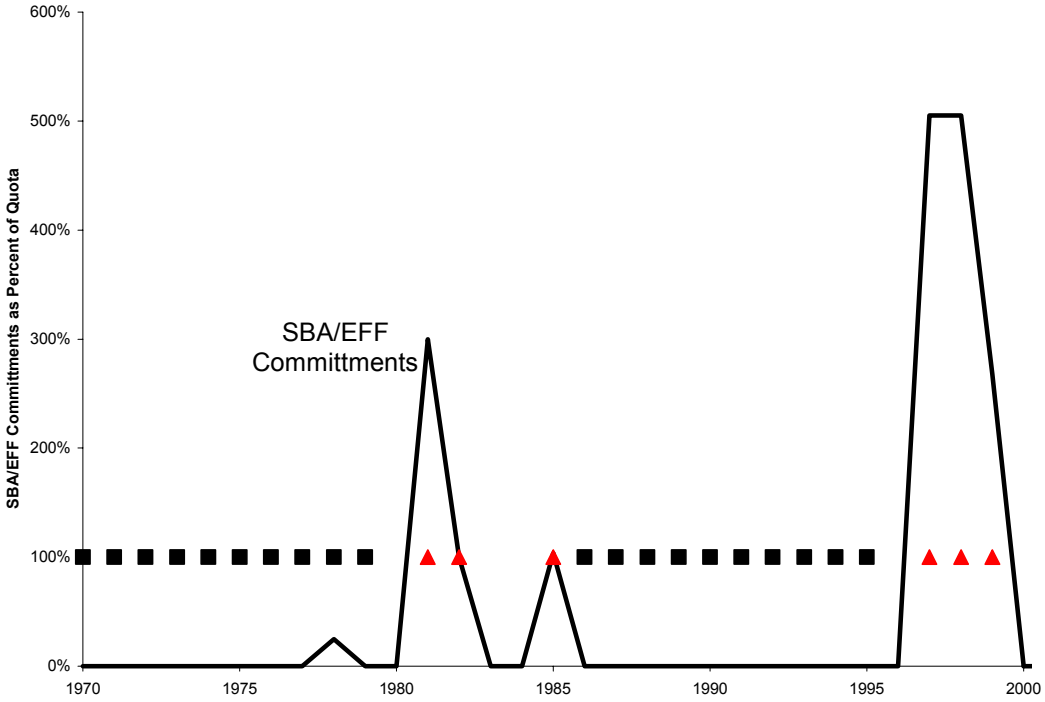

Figure 2: Incidence of Debt Distress Events

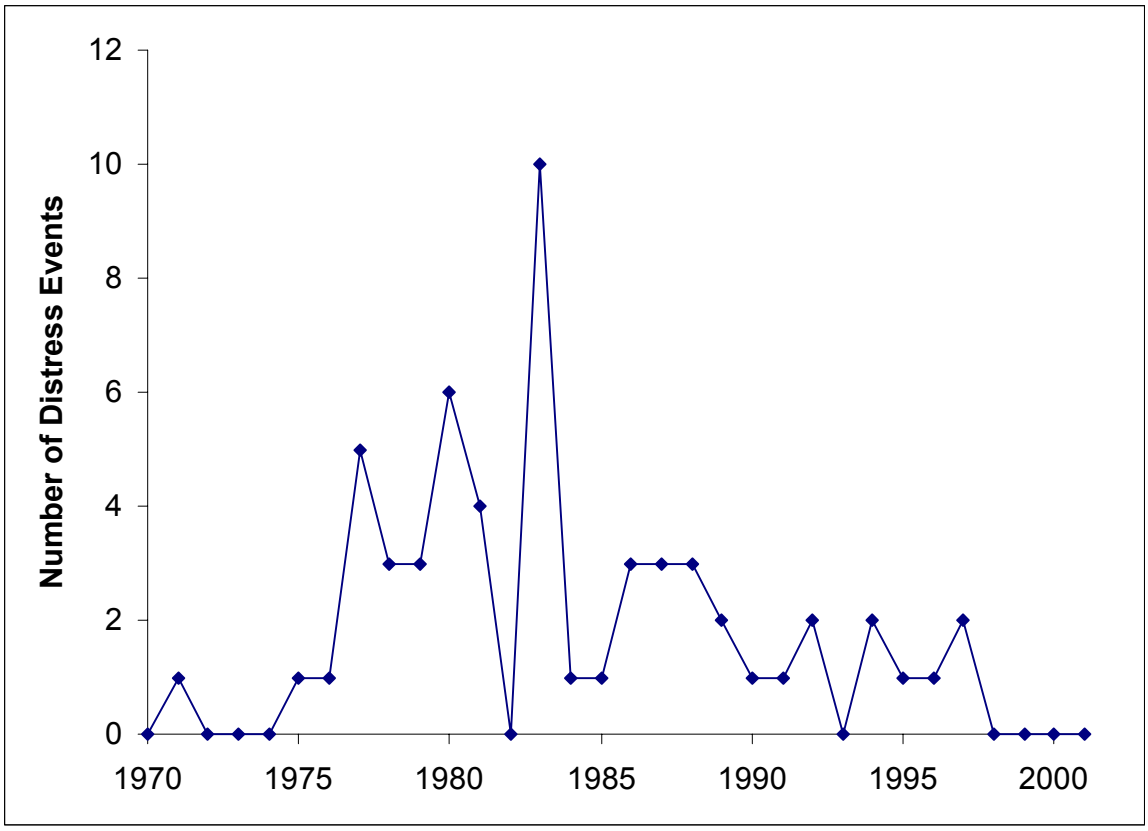

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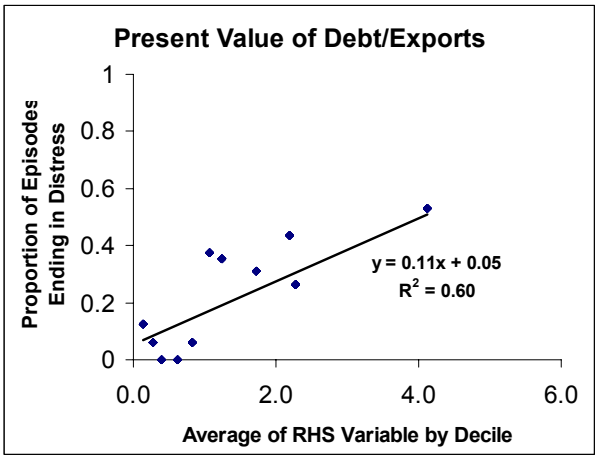
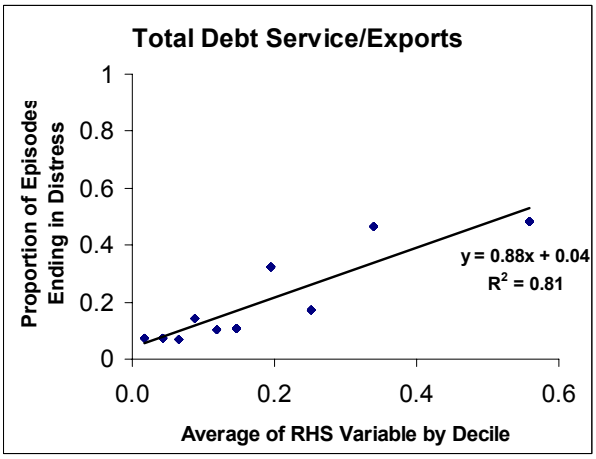
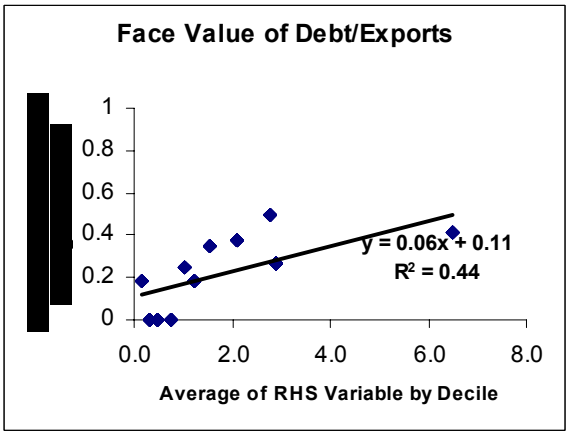
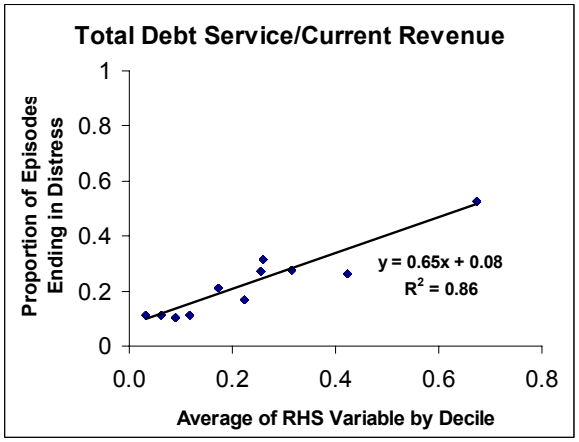
Figure 3: Correlates of Debt Distress -- Debt Indicators









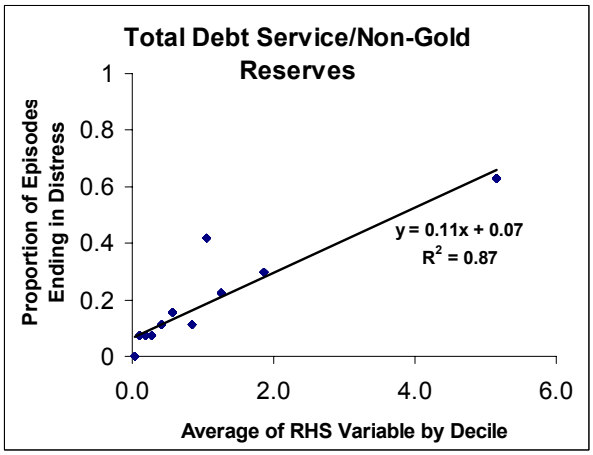
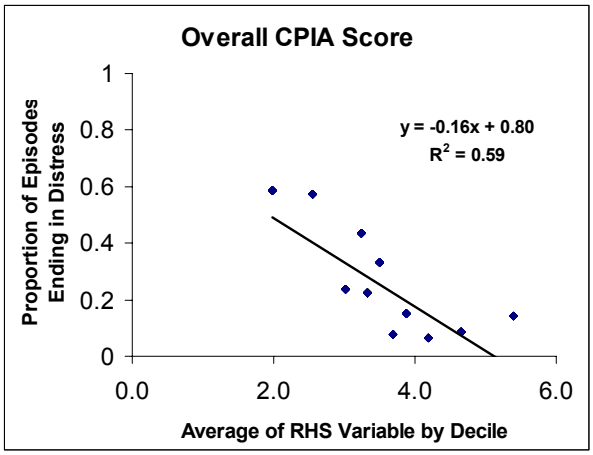
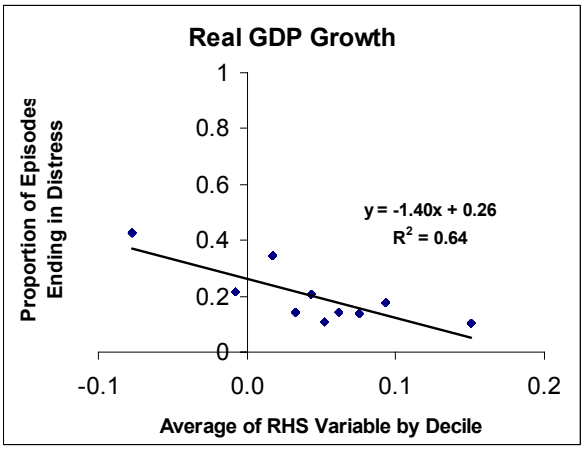
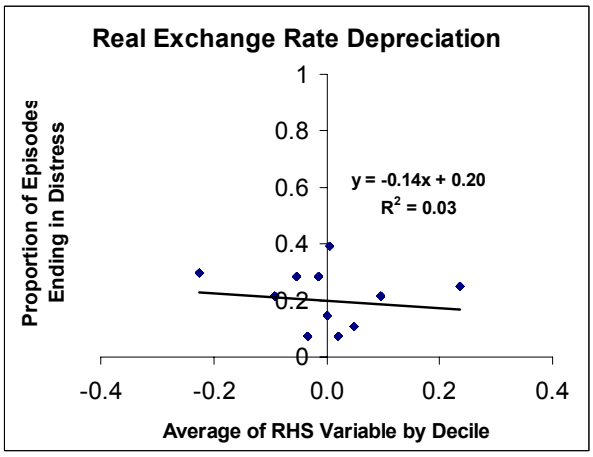


Figure 3 Cont'd: Correlates of Debt Distress – Policies and Shocks







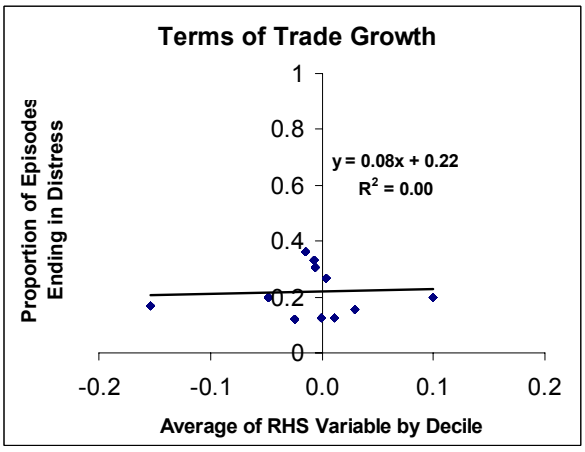


Figure 4: Debt Levels and Debt Distress Probabilities

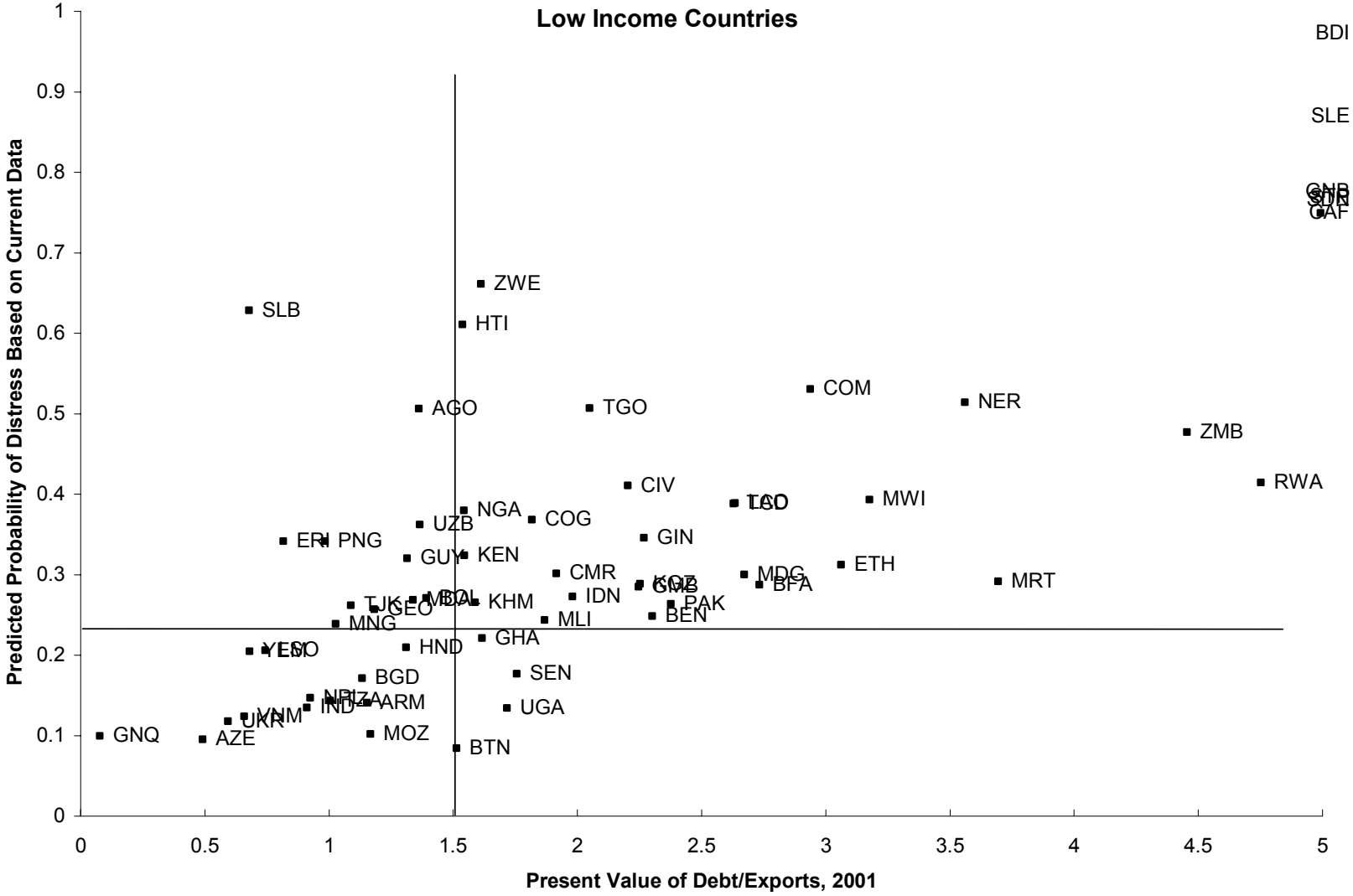
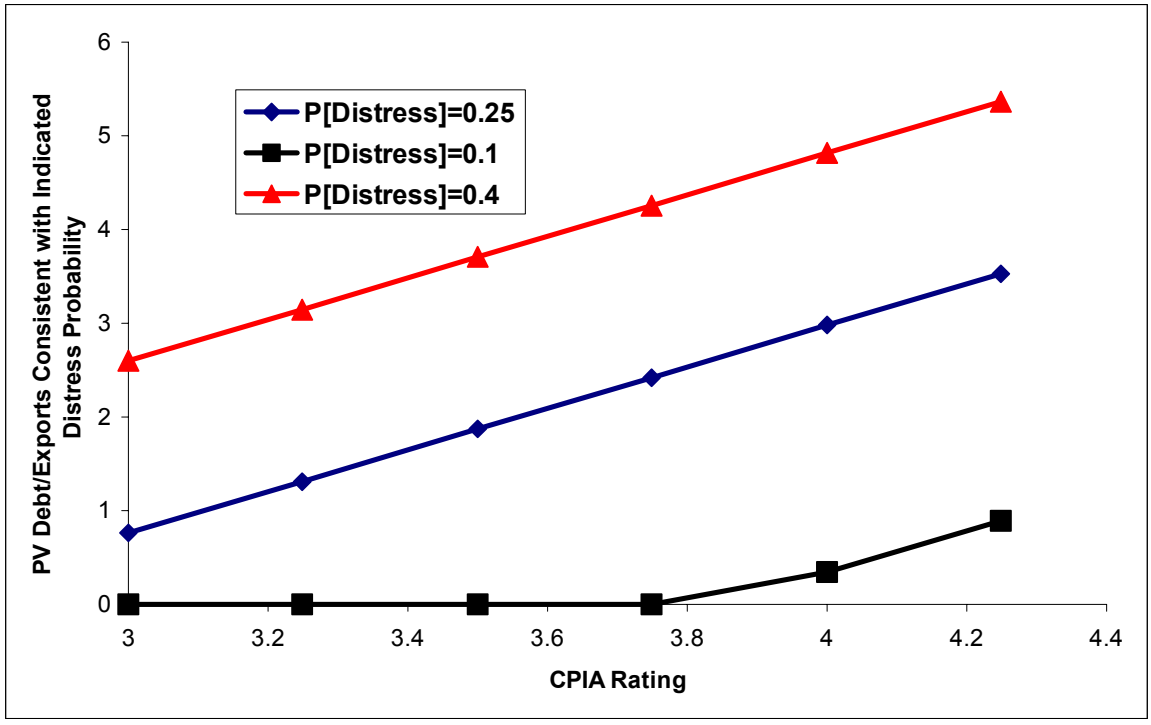


Figure 5: Policies, Growth, and Debt Distress Probabilities



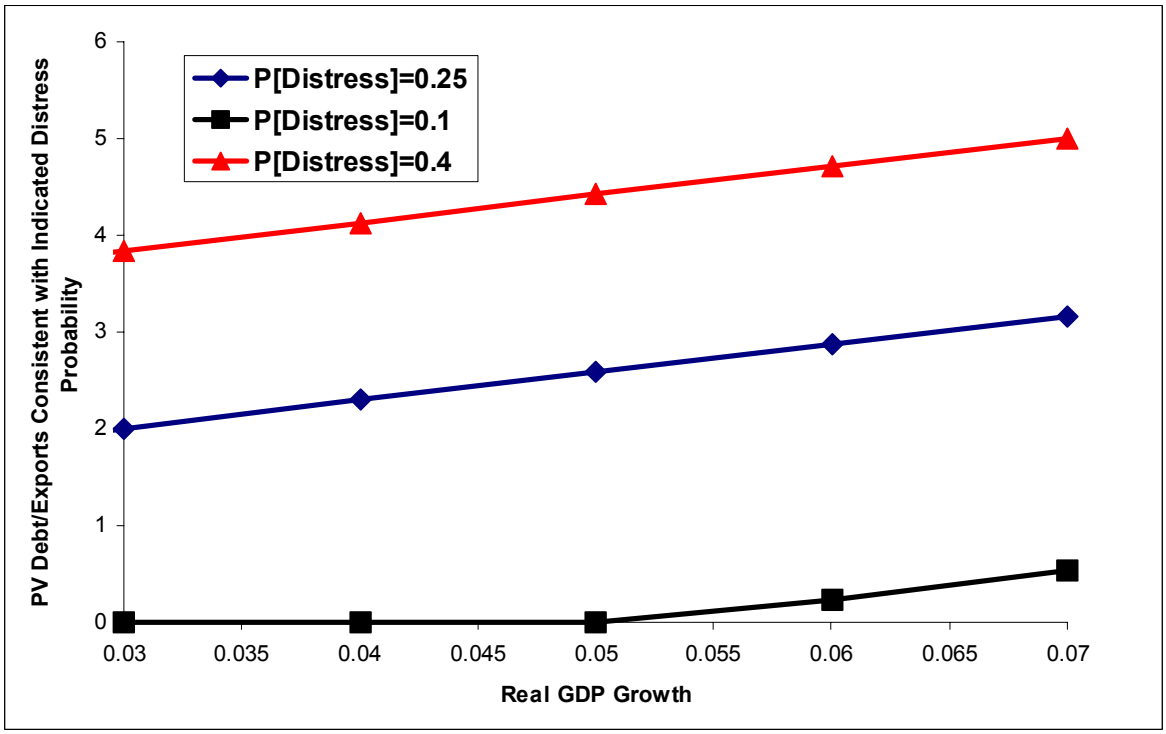


Figure 5: Increase in Debt Distress Probabilities Due to New Concessional Lending

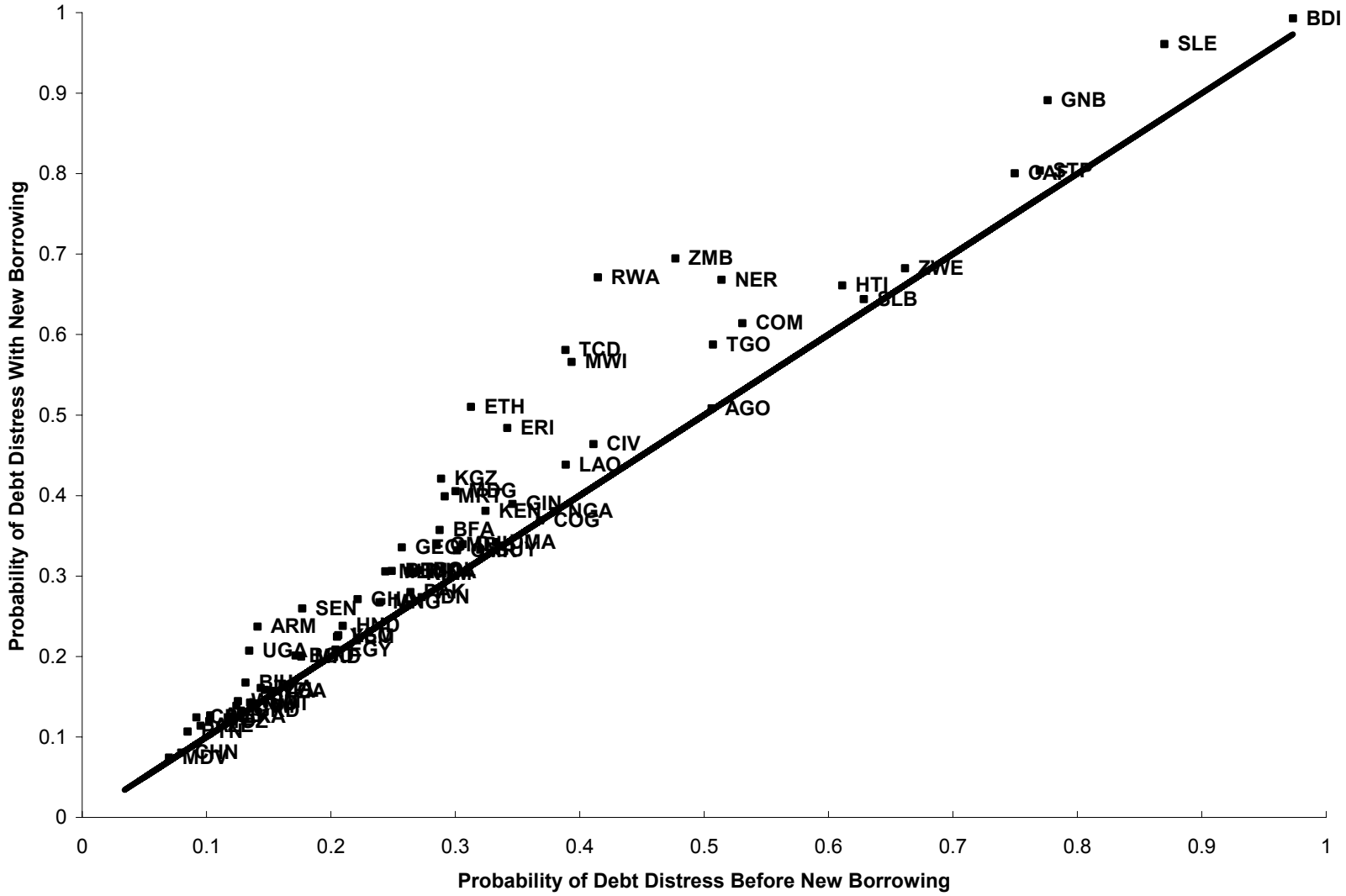


Table 1: Distress Events

			Average During Episode of:		
	Start Year	End Year	Arrears/DOD	Paris Club Relief/DOD	SBA/EFF Commitments/Quota
ALB	1992	2002	0.05	0.03	0.06
ARG	1983	1996	0.08	0.01	1.13
BEN	1983	1999	0.12	0.03	0.00
BFA	1987	1999	0.05	0.01	0.00
BGD	1979	1982	0.00	0.00	2.53
BRA	1983	1986	0.01	0.01	2.90
CAF	1971	2000	0.11	0.01	0.10
CHL	1983	1990	0.00	0.00	1.34
CIV	1981	1997	0.10	0.02	1.03
CMR	1987	2000	0.10	0.05	0.22
COG	1985	2000	0.23	0.06	0.21
COM	1987	2000	0.17	0.00	0.00
CPV	1988	2000	0.10	0.00	0.00
CRI	1980	1996	0.08	0.01	0.64
DOM	1983	2000	0.12	0.01	0.48
DZA	1994	1998	0.00	0.10	1.08
ECU	1983	1997	0.14	0.01	0.39
EGY	1977	1981	0.02	0.00	1.92
EGY	1984	1996	0.09	0.07	0.28
ETH	1991	2000	0.33	0.01	0.00
GHA	1996	1999	0.01	0.00	0.00
GNB	1981	2000	0.21	0.02	0.00
GUY	1978	2001	0.13	0.04	0.45
HND	1979	2001	0.06	0.01	0.26
HTI	1978	1981	0.00	0.00	1.24
IDN	1997	2002	0.03	0.01	2.82
IND	1981	1984	0.00	0.00	2.70
JAM	1977	2000	0.05	0.01	1.25
JOR	1989	2001	0.06	0.04	1.02
KEN	1975	1978	0.00	0.00	1.40
KEN	1992	1997	0.04	0.01	0.00
KHM	1989	2000	0.31	0.01	0.00
LBR	1980	2000	0.46	0.01	0.23
MAR	1980	1995	0.02	0.02	0.92
MDG	1980	2002	0.15	0.03	0.29
MEX	1983	1993	0.00	0.01	1.84
MWI	1979	1986	0.00	0.01	1.89
NER	1983	1991	0.02	0.02	0.21
NGA	1986	2002	0.23	0.08	0.13
NIC	1983	2000	0.29	0.01	0.06
PAK	1980	1984	0.00	0.01	1.82
PAK	1995	2001	0.00	0.02	0.56
PER	1977	1980	0.00	0.00	1.20
PHL	1976	1979	0.00	0.00	1.28
PRY	1986	1995	0.11	0.00	0.00
RWA	1994	2000	0.07	0.01	0.00
SDN	1977	2000	0.45	0.01	0.51
SEN	1980	2002	0.01	0.03	0.32
SLV	1990	1993	0.01	0.02	0.24
SOM	1981	2000	0.38	0.00	0.29
THA	1997	2000	0.00	0.00	4.26
TTO	1988	1993	0.03	0.03	0.22
TUN	1986	1992	0.00	0.00	1.17
TUR	1978	1985	0.00	0.02	2.33
URY	1983	1987	0.00	0.00	1.53
VNM	1988	2000	0.35	0.00	0.05
ZAR	1977	2000	0.25	0.03	0.40

Table 2: Summary Statistics

Normal Times

	N	mean	min	max	p25	p50	p75
Length of Episode	227	5.000	5.000	5.000	5.000	5.000	5.000
Average During Episode of:							
Arrears/DOD	227	0.004	0.000	0.041	0.000	0.000	0.004
Paris Club/DOD	227	0.000	0.000	0.000	0.000	0.000	0.000
SBAEFF/Quota	227	0.033	0.000	0.298	0.000	0.000	0.050
GDP Growth	227	0.052	-0.039	0.199	0.033	0.049	0.070
Value at Beginning of Episode of:							
PV Debt/Exports	126	1.024	0.029	9.920	0.343	0.722	1.263
Debt Service/Exports	227	0.151	0.000	0.626	0.057	0.115	0.219
Debt Service/Revenues	144	0.208	0.007	0.811	0.084	0.171	0.278
Debt Service/Reserves	221	0.754	0.000	7.886	0.158	0.393	0.961
CPIA	227	3.660	2.111	6.000	3.391	3.485	3.795
Real GDP Growth	227	0.051	-0.149	0.301	0.026	0.051	0.078
Real Depreciation	224	0.001	-0.453	0.482	-0.049	-0.002	0.045
TOT Growth	199	-0.008	-0.352	0.234	-0.026	-0.002	0.013

Distress Events

	N	mean	min	max	p25	p50	p75
Length of Episode	57	11.281	3.000	29.000	5.000	11.000	16.000
Average During Episode of:							
Arrears/DOD	57	0.099	0.000	0.460	0.003	0.053	0.130
Paris Club/DOD	57	0.017	0.000	0.100	0.003	0.011	0.022
SBAEFF/Quota	57	0.828	0.000	4.262	0.100	0.404	1.246
GDP Growth	57	0.029	-0.025	0.087	0.014	0.032	0.043
Value at Beginning of Episode of:							
PV Debt/Exports	37	2.120	0.015	8.170	1.153	1.940	2.423
Debt Service/Exports	57	0.313	0.000	0.968	0.135	0.268	0.395
Debt Service/Revenues	41	0.347	0.015	1.400	0.184	0.271	0.485
Debt Service/Reserves	47	2.589	0.103	9.374	0.582	1.744	3.268
CPIA	57	3.127	1.000	5.125	2.500	3.222	3.500
Real GDP Growth	57	0.018	-0.277	0.167	-0.010	0.026	0.066
Real Depreciation	54	-0.008	-0.456	0.516	-0.071	-0.015	0.064
TOT Growth	51	-0.018	-0.627	0.123	-0.018	-0.004	0.006

Table 3: Correlation Among Distress Variables

	PV Debt/ Exports	Debt Service/ Exports	CPIA	Real GDP Growth	Real Depreciation	TOT Growth
PV Debt/Exports	1 163					
Debt Service/Exports	0.454 163	1 284				
CPIA	-0.2599 163	-0.0254 284	1 284			
Real GDP Growth	-0.1631 163	-0.1575 284	0.1006 284	1 284		
Real Depreciation	0.0754 158	0.2056 278	0.0411 278	0.0209 278	1 278	
TOT Growth	-0.0176 142	0.0404 250	0.1 250	0.1525 250	-0.0085 248	1 250

Table 4: Determinants of Debt Distress

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PV Debt/Exports	0.317 (0.079)***				0.228 (0.086)***		0.064 (0.100)	
Total Debt Service/Exports		3.615 (0.720)***				4.011 (0.992)***	3.750 (0.991)***	3.341 (0.063)***
CPIA Rating			-0.627 (0.144)***		-0.514 (0.153)***	-0.652 (0.159)***	-0.625 (0.164)***	-.640 (0.144)***
Real GDP Growth				-7.178 (1.993)***	-6.670 (2.303)***	-5.075 (2.475)**	-5.009 (2.483)**	-3.358 (1.684)**
Constant	-1.206 0.162***	-1.580 (0.205)***	1.438 (0.506)***	-0.539 (0.126)***	0.915 (0.587)	0.765 (0.556)	0.630 (0.596)	0.801 (0.502)
# Observations	163	163	163	163	163	163	163	284
Pseudo R-Squared	0.087	0.184	0.127	0.085	0.234	0.348	0.350	0.242
Out-of-Sample Predictive Power								
Correct Predictions	0.51	0.67	0.67	0.43	0.70	0.84	0.84	0.69
Distress Events	0.90	0.80	0.60	0.80	0.70	0.70	0.70	0.90
False Alarms	0.55	0.35	0.32	0.63	0.30	0.13	0.13	0.34

Table 5: Robustness of Basic Result: Alternative Debt Measures

	(1)	(2)	(3)	(4)	(5)	(6)
Face Value Debt/Exports	0.11 (0.06)*			0.11 (0.06)*		
Debt Service/Revenues		3.18 (0.89)***			3.01 (0.70)***	
Debt Service/Reserves			0.35 (0.08)***			0.33 (0.06)***
CPIA Rating	-0.54*** (0.15)	-0.64 (0.19)***	-0.52 (0.18)***	-0.54 (0.15)***	-0.75 (0.17)***	-0.52 (0.16)***
Real GDP Growth	-6.77 (2.27)***	-3.27 (3.02)	-4.48 (2.72)*	-6.77 (2.27)***	-0.22 (2.10)	-3.31 (1.90)*
Constant	1.12 (0.58)	0.64 (0.63)	0.66 (0.63)	1.12 (0.58)	1.09 (0.56)	0.58 (0.57)
# Observations	163	121	153	163	185	268
Pseudo R-Squared	0.21	0.26	0.30	0.21	0.19	0.23

Table 6: Robustness of Basic Result: Alternative Policy and Shock Measures

	(1)	(2)	(3)	(4)	(5)	(6)
PV Debt/Exports	0.25 (0.08)***		0.27 (0.09)***	0.56 (0.14)***		
Total Debt Service/Exports		3.16 (0.58)***			3.90 (0.67)***	3.51 (0.64)***
CPIA Rating			-0.42 (0.16)***	-0.45 (0.18)***	-0.56 (0.15)***	-0.54 (0.15)***
KK Rule of Law Index	-0.36 (0.19)*	-0.42 (0.15)***				
Real GDP Growth	-6.97 (2.19)***	-3.77 (1.55)**				
Real Depreciation			-0.28 (0.85)		-1.47 (0.80)*	
Terms of Trade Growth				0.06 (1.40)		-1.21 (1.28)
Constant _CONS	-1.02 (0.18)***	-1.52 (0.19)***	0.29 (0.61)	0.11 (0.69)	0.25 (0.53)	0.26 (0.56)
# Observations Pseudo R-Squared	162 0.18	283 0.19	158 0.15	142 0.23	278 0.22	250 0.22

Table 7: Robustness Checks: Role of Level of Development

	(1)	(2)	(3)*	(4)*	(5)*	(6)*
			Low-Income Sample		*High-Income Sample*	
PV Debt/Exports	0.63		0.043		0.200	
	(0.16)***		(1.52)		(3.84)***	
Total Debt Service/Exports		3.69		0.787		0.772
		(0.69)***		(2.75)***		(4.39)***
CPIA Rating	-0.50	-0.51	-0.162	-0.241	-0.076	-0.058
	(0.18)***	(0.16)***	(2.48)**	(4.17)***	(1.77)*	(1.37)
GDP Growth	-5.68	-3.88	-1.386	-0.291	-1.413	-1.511
	(2.67)**	(1.82)**	(1.49)	(-0.53)	(1.76)*	(2.47)**
Log(Real Per Capita GDP)	0.30	-0.22				
	(0.21)	(0.15)				
Constant	-2.04	1.96*				
	(1.79)	(1.13)				
# Observations	144	258	81	139	82	145
Pseudo R-Squared	0.31	0.26	0.18	0.21	0.46	0.33

* These columns report estimated marginal effects. Absolute value of t-statistics associated with the underlying slope coefficients are reported in parentheses.

Table 8: Robustness Checks: Role of History

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PV Debt/Exports	0.54 (0.15)***		0.23 (0.09)**		0.23 (0.09)**			0.212 (0.087)**
Total Debt Service/Exports		3.25 (0.66)***		3.57 (0.65)***		3.33 (0.63)***		
CPIA Rating	-0.46 (0.18)**	-0.59 (0.17)***			-0.54 (0.16)***	-0.62 (0.15)***		-0.515 (0.155)***
GDP Growth	-7.01 (2.79)**	-2.76 (1.91)	-6.58 (2.32)***	-3.35 (1.65)**				-6.496 (2.305)***
Inflation History	2.08 (1.04)**	-0.17 (0.71)						
Average CPIA			-0.43 (0.28)*	-0.95 (0.22)***				
CPIA Deviation			-0.57 (0.22)***	-0.49 (0.16)***				
Average GDP Growth					-0.32 (7.31)	-6.99 (6.12)		
GDP Growth Deviation					-7.71 (2.63)***	-3.02 (1.76)*		
Fraction of years in default prior to 1980							2.306 (0.905)**	1.929 (1.021)*
Constant	0.21 (0.70)	0.61 (0.62)	0.62 (1.03)	1.80 (0.73)	0.72 (0.63)	0.90 (0.53)	-0.864 (0.120)***	0.839 (0.594)
# Observations	149	250	163	284	163	284	163	163
Pseudo R-Squared	0.31	0.22	0.23	0.26	0.24	0.24	0.04	0.26
P[Average = Deviation]			0.73	0.06	0.36	0.54		

Table 9: Dynamic Fixed-Effects Probit Specification

	(1)	(2)
Present Value of Debt/Exports	0.816 (0.335)**	
Total Debt Service/Exports		6.208 (1.728)***
CPIA Rating	-0.697 (0.408)*	-0.506 (0.227)**
Real GDP Growth	-12.878 (4.377)***	-4.726 (2.873)*
Lagged Distress Indicator	-0.707 (0.786)	-0.861 (0.634)
Initial Value of Dependent Variable	-0.119 (0.747)	0.669 (0.662)
Average Present Value of Debt/Exports	-0.742 (0.377)**	
Average Total Debt Service/Exports		-2.942 (1.869)
Average CPIA Rating	0.018 (0.425)	-0.503 0.441
Average Real GDP Growth	18.095 (8.004)**	8.961 (5.494)
Constant	1.024 (1.027)	1.876 (1.180)
Number of Observations	140	200
Number of Countries	68	85
Average Observations Per Country	2.1	2.4